SECOND QUARTER 2023 PROGRESS REPORT / FIRST QUARTER 2023 GROUNDWATER PERFORMANCE MONITORING REPORT
SEAPORT SEATTLE TERMINAL
(FORMER ARCO/BP HARBOR ISLAND TERMINAL)
CLEANUP SITE ID: 4426
1652 SW LANDER STREET
SEATTLE, WASHINGTON

CONSENT DECREE NO. 00-2-05714-8SEA

JULY 2023

Prepared for
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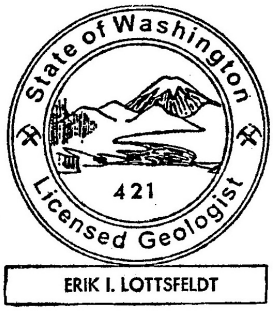

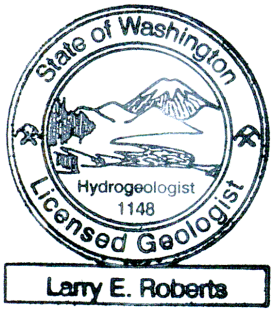

TABLE OF CONTENTS

1. INTRODUCTION

TechSolve Environmental, Inc. (TechSolve) is submitting this report on behalf of TLP Management Services LLC to summarize the First Quarter 2023 Groundwater Monitoring event and operation and maintenance of the waterfront remediation system during the second quarter (March through June) of 2023 for the Seaport Seattle Terminal (former ARCO/BP Harbor Island Terminal Site). The combination of these two summary reports was based upon a Washington State Department of Ecology (Ecology) recommendation (Ecology, 2004a). This report also includes summaries of additional waterfront investigation and groundwater monitoring activities conducted per discussions with Ecology earlier this year. This progress report satisfies reporting schedule submittal requirements pursuant to Ecology Consent Decree No. 00-2-05714-8SEA (Ecology, 2000b).

2. REMEDIATION SYSTEM OPERATIONS

Remediation systems were installed and completed at the Site in accordance with specifications of the Engineering Design Report (EDR) (TechSolv and AG&M, 2000) and Cleanup Action Plan (CAP) (Ecology, 1999). Through the second quarter of 2023, a waterfront groundwater/Light Non-Aqueous Phase Liquid (LNAPL) remediation system has operated to remove free-phase LNAPL and dissolved petroleum hydrocarbons from groundwater at Plant 1 (Figure 1).

2.1. WATERFRONT SYSTEM OPERATIONS

Installation, startup, and testing of the final waterfront remediation system was completed in 2002 and 2003. Standard operation began once testing showed the system operated as designed. System construction and operation and maintenance (O&M) are detailed in the Construction Completion Report (CCR) (TechSolve, 2003a) and Final O&M Manual (TechSolve, 2003b), which were approved by Ecology (Ecology, 2004b). The O&M Manual is updated as practices or procedures change, or as systems are altered.

O&M activities are conducted on systems to ensure they operate as designed and in accordance with applicable permits. These activities include, but are not limited to:

- Weekly checks of groundwater recovery system pumping rates.
- Weekly inspections of system components and waste storage containers for integrity per the requirements of WAC 173-303-320.
- Monthly sampling of recovered groundwater influent and effluent streams to ensure compliance with King County Department of Natural Resources and Parks (KCDNR) Discharge Permit 7592-05 for discharge A43262.
- Monthly monitoring and calculation of system LNAPL recovery.
- Monthly sampling of system flow rates and hydrocarbon concentrations.

Additional maintenance activities are conducted as needed to maintain system operational integrity and to ensure discharges are within permitted ranges.

Operation of waterfront air sparging and SVE systems were discontinued in May 2008, as the bulk of available hydrocarbons had been recovered (TechSolve, 2009).

Combined LNAPL recovery (free-phase, residual, and dissolved) from final SVE and groundwater/ LNAPL recovery systems is approximately 14,559 gallons (October 2002 to June 2023) (Table 1). Interim systems, operating from 1992 through 2002, recovered an additional 15,223 gallons of LNAPL, for a combined LNAPL recovery of 29,782 gallons. The majority of LNAPL recovered by interim remediation systems was free-phase LNAPL. The majority of LNAPL recovered by final remediation systems was from enhanced biodegradation, calculated from CO_2 in SVE vapor.

Groundwater/LNAPL recovery system data presented in Table 1 show influent concentrations of dissolved benzene, diesel, and gasoline in recovered groundwater (i.e., untreated water pumped from recovery wells screened in shallow groundwater) have decreased over time. During the second quarter of 2023, influent concentrations of dissolved benzene, diesel, and gasoline in all monitoring events were below associated surface water cleanup levels (CULs), which are applicable to confirmational monitoring wells screened where groundwater and surface water exchange is occurring. Table 1 also shows that measurable volumes of free-phase LNAPL have not been generated since 2008, which was the last time sufficient LNAPL was recovered to warrant offsite shipment. These data correspond with the lack of free-phase LNAPL observed in recovery wells used by the groundwater/LNAPL recovery system. Lack of free-phase LNAPL in wells and limited free-phase LNAPL recovery by the groundwater/LNAPL recovery system indicate that the recovery system has captured most available free-phase LNAPL. Evaluations conducted during 2019 (TechSolve, 2020a) and detailed in the 2019 and 2020 Annual Site Reports (TechSolve, 2020b and 2021) determined that free-phase and recoverable LNAPL appears to no longer be present and LNAPL has been recovered to the extent practicable. Negotiations are ongoing with Ecology regarding discontinuing operation of the groundwater/LNAPL recovery system.

Effluent discharges from the groundwater/LNAPL recovery system to the sanitary sewer have been within KCDNR's permitted ranges (Table 1) in 2023. Average monthly effluent flow rates ranged from 0.72 to 0.95 gallons per minute (gpm) in the second quarter of 2023, below KCDNR's maximum permitted flow of 17.5 gpm, consistent with past rates that have decreased over time.

Maintenance and repair activities of remediation systems and wells are conducted to maintain integrity, effective operation, capture, and hydraulic control along the waterfront. Notable activities conducted in the second quarter of 2023 include:

- Cleanout and service of remediation system groundwater treatment system process equipment.
- Piping and system back flushing and preventative maintenance to maintain conveyance piping and pumping from recovery wells.
- Recovery well jetting and cleaning of screened intervals, removal of in-well accumulated sediment, and recovery pump maintenance and repair.
- Replacement of the north boom. The south boom was discontinued per Ecology's approval (TechSolve 2022b).

Data show that the system continues to operate as designed and in accordance with permit requirements.

2.1.1. RECOVERY WELL MONITORING

Monitoring of recovery wells for free-phase LNAPL, sheen, and dissolved phase indicator hazardous substance (IHS) concentrations is voluntarily conducted semi-annually and was conducted in June 2023. Monitoring recovery wells for LNAPL presence helps evaluate the attainment of the performance criterion for groundwater/LNAPL recovery system shutdown, which is for LNAPL to be recovered to the extent practicable (i.e., below a measurable threshold of 0.01 foot in thickness). Monitoring for dissolved phase IHSs is conducted as elevated dissolved concentration are an indicator of LNAPL above residual saturation levels that may be recoverable or threaten deeper groundwater. The dissolved phase IHS performance criterion for groundwater/LNAPL recovery system shutdown is attainment of groundwater CULs at conditional points of compliance (CPOCs). The established CPOCs in groundwater near the groundwater/LNAPL recovery system are Confirmation Monitoring Wells AMW-01 through AMW-05, which are screened in deeper groundwater where groundwater and surface water exchange has been shown to occur (Section 3). Attainment of dissolved phase IHS CULs in shallow screened recovery wells is not a performance criterion for groundwater/LNAPL recovery system shutdown.

June 2023 recovery well monitoring (Table 2) showed the following:

- No measurable LNAPL (<0.01 feet) in any of the 10 recovery wells (Figure 2).
- No sheen on groundwater was detectable in 8 of the 10 recovery wells. A slight sheen was detected in one well (RW-2) and a heavy sheen was detected in one well (RW-4).
- Groundwater monitoring for dissolved phase IHSs showed 7 of the 10 recovery wells were below all IHS CULs for benzene, total petroleum hydrocarbons (TPH) as gasoline (TPH-G), TPH as diesel (TPH-D) and TPH as oil (TPH-O), applicable at deeper CPOCs. Samples from three wells (RW-2, RW-4, and RW-8) exceeded the diesel CUL. One well (RW-4) exceeded the gasoline CUL, and at one well (RW-2) the TPH-G concentration was at the CUL. None of the 10 wells exceeded the TPH-O or benzene CULs.

These data have been consistent over the past several years and are consistent with the results of the Waterfront Probing Investigation (TechSolve, 2020a) that was conducted as part of the Hydraulic Evaluation (TechSolve, 2022a). The investigation showed that no recoverable LNAPL remains and dissolved phase IHSs in shallow groundwater are not likely to cause exceedances of IHS CULs at deeper CPOCs. Results will be discussed further in the 2023 Annual Site Report.

2.2. INLAND SYSTEM OPERATIONS

An Inland SVE system operated from 2008 through 2014 to improve soil and groundwater conditions along the southern boundary of Plant 1. The SVE system was shut down as it no longer recovered measurable petroleum hydrocarbons and induced airflow was no longer affecting biodegradation. Information regarding system shutdown was provided in 2015 (TechSolve, 2016). In 2018, a plan (TechSolve, 2018) was submitted to Ecology, subsequently approved (Ecology 2018), and then completed to decommission the mechanical and electrical components of the system that required ongoing maintenance. The in-ground SVE piping and control manifold for this system remain onsite as a contingency in case operation of the system is warranted in the future.

Groundwater monitoring data collected along Plant 1's southern boundary indicate the system improved groundwater conditions in this area of the Site, as discussed in Section 3.

2.3. CONTAINMENT BOOM MONITORING

Oil sorbent booms have been maintained on the West Duwamish Waterway adjacent to Plant 1 to contain oil sheens that have historically appeared on surface water. One boom, the Northern Warehouse Boom, is currently maintained in the waterway adjacent to the warehouse (Figure 2). Boom locations are selected to best contain occasional sheens historically observed on the Western Duwamish Waterway directly adjacent to the Site. Booms and the waterway are monitored weekly, at a minimum, for the presence of oil sheens and boom integrity, and augmented by checks made by Terminal personnel. Booms are replaced, as necessary due to condition. The Northern Warehouse Boom was last replaced on July 7, 2023.

Use of the Southern Warehouse Boom (Figure 2) was discontinued in the second quarter of 2022, following notification to Ecology (TechSolve, 2022b), as no sheen had been observed in the Southern Warehouse Boom since August 2019. Visual monitoring of the Duwamish Waterway for sheen will continue to be conducted weekly at a minimum and the Southern Warehouse Boom will be reinstalled and maintained if sheens are detected at this location in the future.

No sheens on surface water have been observed in the Northern Warehouse Boom during the second quarter of 2023. The last sheen observed in the Northern Warehouse Boom occurred in August 2021 and appeared to be from a third-party source (TechSolve, 2022c). Prior to the 2021 sheen, the last observed sheen on the waterway associated with the terminal occurred in October 2020, which was the only sheen observed in 2020. The lack of an observable sheen on the waterway for extended periods of more than one year indicates that the performance criterion has been met for there to be no persistent sheens associated with the terminal on the waterway. Waterway sheen monitoring results will continue to be evaluated in 2023, per Ecology's request (TechSolve 2023b).

3. SUMMARY OF GROUNDWATER PERFORMANCE MONITORING PROGRAM

The First Quarter 2023 Groundwater Monitoring Event was conducted in accordance with requirements of the Consent Decree, CAP, and Groundwater Compliance Monitoring and Contingency Program (GWCMCP) (TechSolv, 1999) and per Ecology approved revisions included in the EDR and detailed below. The current groundwater monitoring schedule is summarized in Table 3. Plant 1 monitoring well locations are shown on Figure 2. The First Quarter 2023 Groundwater Monitoring event was conducted on March 29, 30, and 31, 2023.

Wells MW-1-T9, MW-2-T9, MW-3-T9, and MW-4-T9 were installed along the southern property boundary of Plant 1 (Figure 2) in 2005 to evaluate groundwater trends due to CUL exceedances in Monitoring Well AR-03. These wells were monitored quarterly until 2018, which helped evaluate the effectiveness of the Inland SVE system (Section 2.2.) in meeting cleanup objectives. In 2018, monitoring revisions (TechSolve, 2018) were approved by Ecology (Ecology 2018) to eliminate monitoring of Well MW-4-T9 and reduce the monitoring frequency of Wells AR-03, GM-15S, MW-1-T9, MW-2-T9, and MW-3-T9 from quarterly to semi-annual, with agreed contingency actions to resume quarterly monitoring if CULs are exceeded in these wells.

Well GM-14S was historically used to monitor for sheens on groundwater, as discussed below. As sheens are no longer detected in GM-14S, quarterly groundwater monitoring for IHSs was initiated in this well in 2007.

Wells GM-16S and GM-17S are hydraulically upgradient from Plant 1. Monitoring of these wells was discontinued with approval from Ecology in March 2000 (Ecology, 2000a), as sufficient upgradient data had been collected. Monitoring was reinitiated in 2007 for potential petroleum hydrocarbon migration onto the property from upgradient, offsite sources. Revisions to the groundwater monitoring program, approved by Ecology in 2009 (Ecology, 2009), reduced the monitoring frequency of Wells GM-16S and 17S from quarterly to semi-annual as TPH and benzene detections had remained consistently below CULs.

Voluntary monitoring for carcinogenic polynuclear aromatic hydrocarbons (cPAHs) was set to an annual basis in waterfront confirmational wells (AMW-01 through AMW-05) as extensive sampling has shown no significant detection trends. Sampling for cPAHs was last conducted in December 2022, as detailed in the 2022 Annual Site Report (TechSolve, 2023a), and will be conducted again in December 2023.

Wells monitored on a semi-annual basis are sampled in the first and third quarter, which typically correspond with seasonal groundwater highs and lows, respectively. As such, Wells AR-03, GM-15S, GM-16S, GM-17S, MW-1-T9, MW-2-T9, and MW-3-T9 were sampled in the first quarter of 2023. These wells will next be sampled in the third quarter of 2023.

Overall, first quarter 2023 groundwater elevations (Table 4) were similar to elevations measured in the fourth quarter of 2022 and higher than elevations measured in the second and third quarters of 2022. These data indicate that the seasonal groundwater high occurred in late 2022 to early 2022, corresponding with historical trends, which are presented in the 2022 Annual Report (Techsolve, 2023a). These trends show groundwater elevations rising to seasonal highs in the winter and spring and falling to seasonal lows in the summer and autumn. Note that elevations listed in Table 4 are now shown relative to the North American Vertical Datum of 1988 (NAVD88), whereas elevations listed in previous reports were relative to the older National Geodetic Vertical Datum of 1929 (NGVD29). Listed NAVD88 elevations are approximately 3.3 feet higher than previous listed NGVD29 elevations. The change in datum was made following a 2021 survey of wells to the current NAVD88 Datum, conducted as part of a 2021 Hydraulic Investigation (TechSolve, 2022a). The new well survey was conducted to ensure data consistency for the investigation.

First Quarter 2023 Groundwater Monitoring Event samples were submitted to ALS Laboratories of Everett, Washington (Ecology Accreditation # C601) for laboratory analysis of IHSs identified in the CAP. The IHSs include TPH-G, TPH-D, TPH-O, and benzene.

Petroleum hydrocarbon monitoring results for the First Quarter 2023 Groundwater Monitoring Event are included in Table 5 and Figure 2. The only detections of IHSs (benzene, TPH-G, TPH-D, or TPH-O) above a CUL were benzene in Well GM-14S and in Well AMW-02. Concentrations of IHSs from all other samples analyzed were below associated CULs. Data trend evaluations will be presented in the 2023 Annual Site Report, in accordance with Consent Decree requirements.

Three wells (GM-11S, GM-12S, and GM-13S) have been examined monthly for the presence of free-phase LNAPL (free product) and sheens. LNAPL and sheen monitoring results are presented in Table 6. Historically, gauging for free-phase LNAPL at Plant 1 was conducted at four wells; however, gauging of Well GM-14S was discontinued in 2004, with concurrence from Ecology (Ecology, 2004c), and converted to a monitoring well in 2007, as it has been free of LNAPL since 1999.

No sheen or measurable LNAPL have been detected in Wells GM-11S, GM-12S, and GM-13S in 2023. Historic sheen monitoring data and trend analyses were presented in the 2022 Annual Site Report (TechSolve, 2023a). Overall, LNAPL and sheen monitoring indicate that these wells meet the GWCMCP LNAPL performance standard of no measurable LNAPL. These three wells will continue to be gauged for sheen and LNAPL in 2023, until Ecology concurs that the GWCMCP product performance standard has been met.

4. SUMMARY OF DATA VALIDATION

Laboratory analytical results were reported with associated laboratory quality assurance/quality control data (QA/QC). Analytical reports were reviewed, and data were validated. During this quarter, some data were qualified with J (the associated value is approximate) and UJ (the associate result is undetected at an approximate quantitation limit) qualifiers. A summary of data qualified during validation, qualifiers assigned, and reasons for data qualification are provided in Table 7. All laboratory reports are retained by TechSolve.

5. ADDITIONAL ACTIVITIES

5.1 NORTHWEST WATERFRONT IMPACTED AREA

On February 21, 2023, a new, small area of stained surface soils/pavement was observed by Terminal staff and TechSolve in the northwest corner of the facility near the waterfront, inboard (east) of the new sheetpile seawall (Figure 3). The staining was observed primarily in small areas (a few square feet) of asphalt, which was soft to the touch. There was also some minor staining that extended into the adjacent gravel accessway to the new seawall (Figure 3). The stained gravel was sampled and submitted for TPH-Hydrocarbon Identification (TPH-HCID) analysis, followed by analysis for TPH-G, TPH-D, and TPH-O (sample 21T-SS-022123). As there are both active and decommissioned below-grade pipelines beneath the stained area, it was decided to expose the piping for visual inspection. Subsequent potholing in two adjacent paved locations exposed the active and decommissioned piping. The soil staining continued down to where the water table was encountered at the base of the piping in the first excavation at approximately 4.5 to 5.0 feet below ground surface (bgs). The smaller, second test pit showed no signs of staining or odor. A soil sample was collected at approximately 4.5 feet bgs from the larger, first test pit (21T-SS-022823) and submitted for laboratory analysis to determine if the staining could be from a new source. This soil sample was analyzed for concentrations of TPH-G, TPH-D, and TPH-O, and benzene. Product samples were also collected from the two active pipelines (one containing ultra-low-sulfur diesel #1 and the other containing ultra-low-sulfur diesel #2) and submitted to the laboratory for the same analyses to provide a forensic evaluation of the freshness of the staining and whether the pipelines could be the source.

No evidence of a new release was observed in either of the test pits. Only an occasional sheen was observed on the water table in the larger test pit for the approximately 5 weeks that the excavations were left open. No sheen was observed in the second, smaller test pit. The laboratory analytical results indicated that the soil and gravel samples collected did not contain petroleum hydrocarbons or benzene above CULs (Table 8). The results of the forensic analysis of the soil and gravel samples and pipeline product samples indicated that the LNAPL in the soil/gravel was highly weathered diesel. The LNAPL staining is similar to that detected in other areas along the waterfront during the Remedial Investigation/Feasibility Study, as summarized in the Consent Decree, and in subsequent waterfront investigations. The pipelines were taken out of service, hydrostatically pressure tested, and showed no drop in pressure, confirming that they were not the source for the new stained area. The lines were also visually inspected and re-coated, showing no signs of fatigue or failure. Approximately 10 cubic yards (yds^3) of LNAPL-stained soils were excavated from the test pits and transported offsite for proper disposal. The excavations were backfilled with imported gravel and the area was repaved.

Groundwater samples were also collected from adjacent shallow monitoring wells that bracket the area of the staining (Figure 3). The laboratory results for the three groundwater samples (GM-10S, HMW-01S, and B-007) all showed non-detections for TPH-G, TPH-D, TPH-O, and benzene (Table 8). Additional soil samples (DA1-VLT-01, DA1-TR01-35, and DA1-TR02-35) were subsequently collected in the vicinity of the soil staining area during the installation of piping and a vault box as part of upgrading the waterfront storm drain system (Figure 3). The samples were collected from below the bases of the vault and piping trench excavations using a hand auger and were collected from depths of approximately 4.5 bgs. The laboratory results for these samples are presented in Table 8. Only minor detections of TPH were reported for the two trench samples (DA1-TR01-35, and DA1-TR02-35). The vault sample (DA1-VLT-01) result was the only concentration above the soil CUL of 10,000 milligrams per kilogram (TPHG+TPHD+TPHO). An additional approximately 20 yds^3 of soil containing some LNAPL (both clean and stained soils were included) were excavated during the stormwater upgrade activities for proper disposal, with subsequent backfilling with clean imported materials.

The results of the investigation and evaluation of this new area of observed staining were reviewed with Ecology during an onsite meeting with TechSolve and TLP Management Services L.L.C. (the Site operators) on June 12, 2023. The results show that the area of staining is due to a previously undetected small, localized pocket of old, highly weathered LNAPL, which was likely mobilized and brought to the surface by the extreme king tide that flooded the terminal on December 27, 2022. A discussion of this event was detailed in the recent 2022 Annual Report (TechSolve, 2023a). This small area is not impacting the area groundwater, is well-contained behind the new seawall (and the old bulkhead that remains in place), and is not impacting the Duwamish Waterway, as no sheen has been observed on the waterway (Table 9). Any potential risks that may be associated with the remaining stained soils have been, and will continue to be, mitigated under the natural attenuation remedy of the Consent Decree as other inaccessible soils along the waterfront are. The monitoring wells that were sampled as part of this investigation are planned to be sampled for another three quarters and the results will continue to be reported to Ecology.

5.2 PIEZOMETER SAMPLING

Eleven temporary piezometers that were installed and sampled as part of the Hydraulic Evaluation (TechSolve, 2022a) were re-sampled in April/May 2023 to monitor the shallow groundwater along the waterfront, as requested by Ecology (TechSolve, 2023c). The monitoring was requested to support continuing evaluation and discussions with Ecology for discontinuing the waterfront active remediation and moving forward towards Site closure with natural attenuation groundwater monitoring. The preliminary results of this sampling were discussed with Ecology during the recent onsite meeting. Results of the groundwater sampling at these piezometers, compared with the previous sampling results, show that the remedies implemented per the Consent Decree have been very effective at protecting the Duwamish Waterway. The results also support discontinuing active remediation activities and moving towards monitoring of the ongoing natural attenuation remedial actions along the waterfront. The monitoring will include an additional three quarters of sampling and laboratory analysis of monitored natural attenuation (MNA) parameters as requested by Ecology during the onsite meeting (TechSolve, 2023b). The results of the piezometer monitoring will be evaluated with the results of the current groundwater monitoring. Ecology will continue to be kept informed of the plans for and results of the sampling which will be produced in a separate report.

6. SUMMARY

This report summarizes the operation of remediation systems during the second quarter of 2023 (March through June) and the First Quarter 2023 Groundwater Monitoring Event. Additional investigation activities conducted along the waterfront during this reporting period are also included.

The results of the investigation of the new area of surface soil staining show that the staining is due to a small, localized pocket of old, highly weathered LNAPL. This pocket was previously undetected and was likely mobilized and brought to the surface by the extreme king tide that flooded the terminal at the end of 2022. This pocket is mostly below soil CULs, is not significantly impacting groundwater, is well-contained by both the new seawall, and the old island bulkhead, and is not impacting the Duwamish Waterway. Only one soil sample out of five collected from near the water table within and surrounding the stained area contained TPH above CULs. A total of approximately 30 yds^3 of soil containing some LNAPL were excavated from this area and properly disposed of. Any potential risk presented by any residual LNAPL is being adequately mitigated by the natural attenuation remedy of the Consent Decree. The detection of this new area of staining has been fully addressed and further action is unwarranted.

Ecology has been petitioned (TechSolve, 2022d) to allow discontinuing operation of the waterfront remediation system and proceeding forward with natural attenuation groundwater monitoring. Waterfront temporary piezometers were sampled to support associated ongoing discussions. These piezometers are planned to continue to be sampled quarterly this year, will include monitoring MNA parameters, and the results will be reported to Ecology.

In accordance with the Consent Decree, the Third Quarter 2023 Progress Report/Second Quarter 2023 Groundwater Monitoring Report will be the next report submitted to Ecology. That report will be submitted to Ecology by October 15, 2023.

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TABLES

Table 1. Waterfront Groundwater System Petroleum Hydrocarbon Recovery Rates
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

GROUNDWATER SYSTEM EFFICIENCIES

SAMPLE DATE	UNITS	Influent Benzene	Effluent Benzene	% Reduction	Influent Diesel	Effluent Diesel	% Reduction	Influent Ethylbenzene	Effluent Ethylbenzene	% Reduction	Influent Gasoline	Effluent Gasoline	% Reduction	Influent Oil	Effluent Oil	% Reduction	Influent Toluene	Effluent Toluene	% Reduction	Influent Xylenes	Effluent Xylenes	% Reduction
2002 Averages	µg/L	**225.3**	14.3	91%	7,315	7,020	NA	55.2	6.2	75%	**1,770**	336	82%	831	804	NA	17.0	2.5	88%	88.8	9.9	87%
2003 Averages	µg/L	**137.7**	19.5	76%	4,945	4,648	NA	44.5	12.9	69%	**1,854**	678	62%	760	763	NA	42.7	5.4	61%	154.1	50.3	68%
2004 Averages	µg/L	**93.5**	3.2	82%	**10,285**	9,342	NA	76.8	4.7	79%	**4,383**	840	59%	762	1,026	NA	116.6	2.2	82%	356.6	23.0	75%
2005 Averages	µg/L	**76.7**	14.5	84%	4,162	5,987	NA	170.8	45.4	81%	**10,090**	3,229	70%	864	750	NA	566.9	121.0	84%	1,327.7	367.9	78%
2006 Averages	µg/L	38.9	1.2	89%	**11,263**	2,174	NA	42.1	0.9	90%	**4,944**	202	94%	665	666	NA	55.6	0.8	77%	485.1	5.2	96%
2007 Averages	µg/L	8.8	1.5	60%	1,223	906	NA	6.6	0.8	56%	407	115	63%	598	598	NA	1.0	0.5	21%	19.8	1.9	50%
2008 Averages	µg/L	10.0	1.1	70%	540	468	NA	5.5	0.7	39%	279	76	61%	505	504	NA	0.7	0.5	40%	10.6	1.6	65%
2009 Averages	µg/L	5.2	1.0	48%	369	561	NA	4.1	1.6	31%	407	182	46%	497	489	NA	0.8	0.7	44%	15.2	7.4	33%
2010 Averages	µg/L	3.9	0.7	76%		2,193	NA	6.8	1.7	78%	915	336	*65%*		*410*	NA	*0.9*	*0.9*	NA	26.3	6.7	69%
2011 Averages	µg/L	3.2	0.5	80%		1,714	NA	2.4	1.0	53%	439	89	*69%*		*492*	NA	*1.0*	*1.0*	NA	7.1	3.0	29%
2012 Averages	µg/L	3.6	1.3	48%		2,787	NA	1.9	1.2	37%	362	144	*61%*		*636*	NA	*1.0*	*1.0*	NA	5.7	3.4	48%
2013 Averages	µg/L	1.0	0.5	45%		1,333	NA	1.1	0.5	49%	356	124	*57%*		*433*	NA	*0.5*	*0.5*	NA	2.4	1.0	78%
2014 Averages	µg/L	1.7	0.3	61%		1,699	NA	0.6	0.3	46%	539	122	*79%*		*236*	NA	*0.5*	*0.3*	NA	1.5	0.5	61%
2015 Averages	µg/L	2.3	0.4	66%		5,175	NA	1.6	0.4	60%	**1,146**	406	*64%*		*396*	NA	*0.5*	*0.4*	NA	2.8	0.5	74%
2016 Averages	µg/L	2.2	0.6	76%		2,292	NA	2.3	0.5	81%	**1,282**	582	*50%*		*248*	NA	*0.4*	*0.4*	NA	2.9	1.0	62%
2017 Averages	µg/L	1.9	0.4	74%		4,325	NA	1.0	0.4	63%	**1,421**	641	*56%*		*349*	NA	*0.5*	*0.4*	NA	1.0	0.7	55%
2018 Averages	µg/L	1.1	0.7	60%		1,673	NA	0.7	0.7	7%	359	136	*62%*		*346*	NA	*0.5*	*0.5*	NA	1.3	0.9	30%
2019 Averages	µg/L	0.5	0.4	50%		1,539	NA	0.7	0.7	NA	231	68	*60%*		*584*	NA	*0.7*	*0.7*	NA	2.0	2.0	NA
2020 Averages	µg/L	0.7	*0.5*	NA		588	NA	*1.0*	*1.0*	NA	100	51	*65%*		*750*	NA	*1.0*	*1.0*	NA	*3.0*	*3.0*	NA
2021 Averages	µg/L	1.6	0.5	*NA*		756	NA	*1.0*	*1.0*	*NA*	110	50	NA		*750*	*NA*	*1.0*	*1.0*	*NA*	3.3	*3.0*	*NA*
2022 Averages	µg/L	1.0	0.5	*NA*		378	NA	*1.0*	*1.0*	*NA*	95	50	NA		*750*	*NA*	*1.0*	*1.0*	*NA*	3.0	*3.0*	*NA*
1/26/2023	µg/L	2.4	*0.5*	*NA*		470	*NA*	*1.0*	*1.0*	*NA*	120	*50*	*NA*		*750*	*NA*	*1.0*	*1.0*	*NA*	*3.0*	*3.0*	*NA*
2/23/2023	µg/L	1.2	*0.5*	*NA*		450	*NA*	*1.0*	*1.0*	*NA*	89	*50*	*NA*		*750*	*NA*	*1.0*	*1.0*	*NA*	*3.0*	*3.0*	*NA*
3/23/2023	µg/L	0.7	*0.5*	*NA*		350	*NA*	*1.0*	*1.0*	*NA*	*50*	*50*	*NA*		*750*	*NA*	*1.0*	*1.0*	*NA*	*3.0*	*3.0*	*NA*
4/20/2023	µg/L	2.7	*0.5*	*NA*		330	*NA*	*1.0*	*1.0*	*NA*	130	*50*	*NA*		*750*	*NA*	*1.0*	*1.0*	*NA*	*3.0*	*3.0*	*NA*
5/25/2023	µg/L	*0.5*	*0.5*	*NA*		520	*NA*	*1.0*	*1.0*	*NA*	*50*	*50*	*NA*		*750*	*NA*	*1.0*	*1.0*	*NA*	*3.0*	*3.0*	*NA*
6/22/2023	µg/L	0.6	*0.5*	*NA*		310	*NA*	*1.0*	*1.0*	*NA*	*50*	*50*	*NA*		*750*	*NA*	*1.0*	*1.0*	*NA*	*3.0*	*3.0*	*NA*
2023 Averages	µg/L	1.3	0.5	*NA*		405	*NA*	*1.0*	*1.0*	*NA*	82	50	*NA*		*750*	*NA*	*1.0*	*1.0*	*NA*	*3.0*	*3.0*	*NA*
SURFACE WATER CLEANUP LEVELS		71 µg/L			10,000 µg/L			NA			1,000 µg/L			10,000 µg/L			NA			NA		
KCDNR DISCHARGE LIMITS			70 µg/L			100,000 µg/L			1,700 µg/L			NA			100,000 µg/L			1,400 µg/L			NA	

METRO DISCHARGE DATA

Observation Date	Days since last monitoring reading	Average flow (GPM)	Total Flow Between Observation dates (gallons)	Pounds of Benzene Removed	Pounds of Gasoline Removed	Pounds of Diesel Removed	Pounds of Oil Removed	Pounds of Toluene Removed	Pounds of Ethylbenzene Removed	Pounds of Xylenes Recovered	Total Gallons Gas, Diesel, and Oil
2002 Totals and Averages	65	4.18	322,785	0.62	4.99	19.42	2.30	0.05	0.13	0.22	**3.90**
2003 Totals and Averages	361	8.03	4,114,867	4.43	62.20	169.14	26.05	1.18	1.47	5.05	**37.76**
2004 Totals and Averages	338	9.58	4,570,461	3.54	175.70	419.25	28.95	5.35	3.16	14.66	**92.43**
2005 Totals and Averages	359	11.17	5,827,144	3.43	447.43	155.78	41.55	25.29	7.69	59.98	**100.52**
2006 Totals and Averages	365	6.40	3,220,733	0.80	192.72	663.65	19.09	2.85	1.89	20.04	**128.92**
2007 Totals and Averages	360	3.17	1,599,607	0.15	9.08	18.30	8.40	0.02	0.11	0.48	**5.20**
2008 Totals and Averages	363	3.19	1,645,810	0.14	3.95	7.21	6.95	0.01	0.08	0.15	**2.59**
2009 Totals and Averages	369	2.98	1,569,390	0.07	5.75	7.81	6.40	0.01	0.06	0.22	**2.89**
2010 Totals and Averages	372	2.17	1,185,127	0.037	8.62	18.84	4.26	0.01	0.05	0.19	**4.66**
2011 Totals and Averages	356	1.90	949,880	0.026	5.13	17.55	3.54	0.01	0.03	0.13	**3.81**
2012 Totals and Averages	371	1.89	948,600	0.034	3.97	25.92	3.47	0.01	0.02	0.04	**4.81**
2013 Totals and Averages	365	1.33	700,450	0.014	2.26	8.80	3.43	0.003	0.01	0.02	**2.08**
2014 Totals and Averages	332	1.62	761,480	0.010	3.43	10.95	1.55	0.003	0.00	0.01	**2.33**
2015 Totals and Averages	358	1.71	874,680	0.015	6.56	36.53	2.92	0.004	0.01	0.02	**6.68**
2016 Totals and Averages	370	1.90	999,770	0.021	13.12	20.02	1.94	0.004	0.03	0.03	**5.26**
2017 Totals and Averages	364	1.65	866,030	0.014	11.96	33.39	2.62	0.004	0.01	0.01	**7.52**
2018 Totals and Averages	371	1.20	641,740	0.006	2.16	9.61	1.79	0.002	0.004	0.007	**1.96**
2019 Totals and Averages	357	1.26	611,500	0.002	1.30	8.72	2.89	0.003	0.003	0.009	**1.84**
2020 Totals and Averages	378	1.06	572,320	0.003	0.46	2.70	3.58	0.005	0.005	0.014	**0.93**
2021 Totals and Averages	358	1.01	572,321	0.008	0.47	3.72	3.19	0.004	0.004	0.014	**1.03**
2022 Totals and Averages	375	0.90	486,520	0.004	0.37	1.64	3.04	0.004	0.004	0.012	**0.69**
January-23	35	2.20	110,660	0.0018	0.14	0.36	0.69	0.0009	0.0009	0.0028	**0.16**
February-23	28	1.11	44,820	0.0007	0.04	0.17	0.28	0.0004	0.0004	0.0011	**0.07**
March-23	28	0.85	34,270	0.0003	0.02	0.11	0.21	0.0003	0.0003	0.0009	**0.05**
April-23	28	0.95	38,420	0.0005	0.03	0.11	0.24	0.0003	0.0003	0.0010	**0.05**
May-23	35	0.83	41,630	0.0006	0.03	0.15	0.26	0.0003	0.0003	0.0010	**0.06**
June-23	28	0.72	29,060	0.0001	0.01	0.10	0.18	0.0002	0.0002	0.0007	**0.04**
2023 Totals and Averages	182	1.11	298,860	0.004	0.270	1.004	1.870	0.002	0.002	0.007	**0.43**
		TOTALS:	**33,340,075 gal**	**13.4**	**961.9**	**1660.0**	**179.8**	**34.8**	**14.8**	**101.3**	
Maximum permitted GPM:		**17.5**	**Gallons Gas, Diesel, & Oil Recovered:**		**156.4**	**237.8**	**23.6**			**Total Gallons Recovered:**	**418.23**

Oil Water Separator Data

Observation Date	Monthly LNAPL Recovery (gal)
February-03	19.6
April-03	6.9
May-03	2.5
July-03	2
December-03	20
January-04	25
June-04	35
August-04	50
September-04	8
November-04	10
December-04	3.5
January-05	0
February-05	35
July-05	110
February-06	5
March-06	2
December-06	30
March-08	30
Total Gallons LNAPL Recovered:	**395**

TOTAL PETROLEUM RECOVERY	
Total lbs. Dissolved Gas, Diesel, and Oil Recovered in Groundwater (2002-Present)	2,802 lbs
Total Gallons Dissolved Gas, Diesel, and Oil Recovered in Groundwater (2002-Present)*	**418 gal**
Total Gallons LNAPL Recovered by Final Recovery System (2002-Present)	**395 gal**
Total Gallons LNAPL Recovered by Interim Recovery System (1992-2002)	**9,312 gal**
Total Gallons of TPH Vapor Recovered by Final SVE System (2003-2008)**	**2,334 gal**
Total Gallons of TPH Vapor Recovered by Interim SVE System (1996-2002)**	**1,248 gal**
Total Gallons TPH Recovered from Final SVE System due to Biodegradation (2003-2008)***	**11,411 gal**
Total Gallons TPH Recovered from Interim SVE System due to Biodegradation (1996-2002)***	**4,664 gal**
Total Gallons Recovered by Final Recovery Systems (2002-Present)	**14,559 gal**
Total Gallons Recovered by Interim Recovery Systems (1992-2002)	**15,223 gal**
Total Gallons of Petroleum Removed (1992-Present)	**29,782.1**

Definitions:

gal - gallons
GPM - Gallons per minute
NA - Not available or could not be calculated due to non-detection
LNAPL - Light non-aqueous phase liquid (oil)
SVE - Soil vapor extraction
TPH - Total petroleum hydrocarbons
µg/L - micrograms per liter

Notes:

LNAPL recovery is recorded periodically when sufficient product has been accumulated to be transported off-site for disposal.
Influent diesel and oil samples are no longer analyzed. Influent and effluent samples are collected before and after, respectively, a diffused air stripper, which does not remove diesel or oil.
Effluent sample data are representative of the outflow water to King County Metro sanitary sewer.
The average µg/L of the preceding month and the month of reference are used to calculate pounds of compound removed.
Data presented in *italicized text* represent non-detections. The listed *italicized value* is the laboratory reporting limit
If influent concentrations are below the laboratories reporting limit, the percent reduction is calculated using the reporting limit. The actual percent reduction is ≥ the reported value.

* Calculation of lbs. of Recovered Product:
To convert µg/L to lbs./gallon - (µg/L)x(3.785l/gal)=ug/gal, (ug/gal)x(ug/(2.2046x10-9lbs))=lbs./gal
lbs./gal of chemical constituent x total gallons recovered =lbs. of chemical recovered
Density of Gasoline utilized for conversions from pounds to gallons is 6.15 lbs./gal
Density of Diesel utilized for conversions from pounds to gallons 6.98 lbs./gal
Density of Oil utilized for conversions from pounds to gallons 7.63 lbs./gal
Benzene, toluene, ethylbenzene, and xylenes volumes are not included in the Total Gallons calculations, as they are assumed to be included in TPH as gasoline.

** / *** SVE Recovery Calculations for TPH and Biodegradation, which are maintained in separate tables.
C = Average Influent TPH concentration (ppmv)
Q = Influent Flow Rate (SCFM)
Mc = Molecular wt. of Carbon Dioxide = 44
Mg = Molecular wt. of Gasoline = 87
Density of Gasoline for conversions is 6.15 lbs./gal

** TPH recovered by SVE system was calculated in lbs./hr. = C x Q x Mg x 1.583 x 10^{-7}
1.583 x 10^{-7} is a constant and is derived as follows:
10^{-6} ppmv x 60min/1hr x 1 lb. Mole/379 cu.ft.
SVE TPH recovery calculations are based on TPH concentrations in the SVE stream, SVE hrs. of operation, and SVE measured flow rates.

Table 2. Groundwater/LNAPL Recovery Well Performance Monitoring
June 2023
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Well	Date	Measurable LNAPL (>0.01')	Sheen on Groundwater (None, SS, MS, HS)	TPH-G NWTPH-Gx (mg/L)	TPH-D NWTPH-Dx (mg/L)	TPH-O NWTPH-Dx (mg/L)	Benzene EPA 8021 (µg/L)
RW-1	6/29/2023	No	None	0.12	0.86	ND	ND
RW-2	6/29/2023	No	**SS**	**1.0**	**15**	ND	16
RW-4	6/29/2023	No	**HS**	**1.90**	**91**	ND	46
RW-5	6/29/2023	No	None	0.32	0.49	ND	0.98
RW-6	6/29/2023	No	None	ND	0.37	ND	ND
RW-7	6/29/2023	No	None	ND	1.6	0.76	ND
RW-8	6/29/2023	No	None	0.073	**12**	ND	ND
RW-9	6/29/2023	No	None	ND	5.7	ND	ND
RW-10	6/29/2023	No	None	0.072	3.2	2.0	ND
GM-11S	6/29/2023	No	None	0.73	6.1	ND	1.4
Cleanup Level		No (<0.01')	No Sheen*	1*	10*	10*	71*
Method Reporting Limit				0.05	0.25	0.75	0.5

Notes:

* Listed cleanup levels and values in **bold** that exceed these levels are applicable at conditional points of compliance (CPoCs).
Recovery wells are not CPoCs for parameters with a " * " and values above listed cleanup levels are not recognized as exceedances.

Definitions:

EPA 8021	EPA method of analysis for volatile organic compounds in water.
mg/L	Milligrams per liter.
µg/L	Micrograms per liter.
ND	Constituent not detected above reporting limit. A less than sign (<) preceeding a value indicates a ND at the listed value.
TPH	Total petroleum hydrocarbons.
TPH-D	Total petroleum hydrocarbons as diesel.
TPH-G	Total petroleum hydrocarbons as gasoline.
TPH-O	Total petroleum hydrocarbons as oil.
NWTPH-Dx	Northwest TPH method for analysis of diesel in water - extended.
NWTPH-Gx	Northwest TPH method for analysis of gasoline in water - extended.
SS	Slight sheen observed on groundwater.
MS	Meduim sheen obaserved on groundwater.
HS	Heavy sheen observed on groundwater.

Table 3. Groundwater Performance Monitoring Schedule

Site: SeaPort Seattle Terminal (Former ARCO/ BP Harbor Island Terminal)

Analyses Conducted by Quarter

Well	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Plant 1				
MW-1-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
MW-2-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
MW-3-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
GM-14S	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O
GM-15S	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
GM-16S	Benzene, TPH-G, TPH-D, TPH-O		Benzene, TPH-G, TPH-D, TPH-O	
GM-17S	Benzene, TPH-G, TPH-D, TPH-O		Benzene, TPH-G, TPH-D, TPH-O	
GM-24S	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O
AR-03	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
AMW-01	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-02	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-03	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-04	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-05	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
Plant 2				
All Plant 2 monitoring has been discontinued.				

Notes: Field Duplicate and QA/QC samples collected from wells highlighted in bold.
TPH-G - Gasoline Range organics utilizing NWTPH-Gx method
TPH-D - Diesel Range Organics utilizing NWTPH-Dx
TPH-O - Extended Range Organics (Motor Oil) utilizing NWTPH-Dx
Benzene is analyzed for utilizing EPA 8021 or 8260B.
cPAHs - Carcinogenic Polycyclic Aromatic Hydrocarbons utilizing EPA 8270SIM
Field Parameters (pH, Temperature, Conductivity, Turbidity, Water Level, & Product Level) are recorded from all wells sampled
(1) - If a groundwater cleanup level exceedance occurs in first or third quarter in any of these highlighted wells, all (1) wells will be sampled the following quarter. Wells exceeding cleanup levels will continue quarterly monitoring until four consecutive quarters below cleanup level are achieved.

Table 4. Groundwater Performance Monitoring Groundwater Elevations
First Quarter 2023
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Well	Date	TOC Elevation (ft NAVD88)	Depth to Water (ft below TOC)	Groundwater Elevation (ft NAVD88)
Plant 1				
GM-14S	3/30/2023	11.77	3.92	7.85
GM-15S	3/29/2023	12.32	4.83	7.49
GM-16S	3/30/2023	11.99	4.42	7.57
GM-17S	3/30/2023	12.56	4.19	8.37
GM-24S	3/30/2023	11.11	2.99	8.12
AR-03	3/29/2023	12.49	4.83	7.66
AMW-01	3/29/2023	12.17	5.71	6.46
AMW-02	3/29/2023	15.36	8.23	7.13
AMW-03	3/29/2023	15.29	8.98	6.31
AMW-04	3/30/2023	11.42	5.49	5.93
AMW-05	3/30/2023	11.05	4.98	6.07
MW-1-T9	3/31/2023	12.21	5.31	6.90
MW-2-T9	3/31/2023	12.37	5.11	7.26
MW-3-T9	3/29/2023	11.87	4.71	7.16

Definitions:

ft	Feet
NA	Not available. Well elevations have not been surveyed.
NAVD88	North American Vertical Datum of 1988
TOC	Top of casing

Table 5. Summary of Analytical Results for Groundwater - TPH-G, TPH-D, TPH-O, and Benzene
First Quarter 2023
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Well	Date	TPH-G NWTPH-Gx (µg/L)	TPH-D NWTPH-Dx (µg/L)	TPH-O NWTPH-Dx (µg/L)	Benzene EPA 8260 (µg/L)
Plant 1					
GM-14S	3/30/2023	600 J	1200 J	ND UJ	**650 J**
GM-15S	3/29/2023	ND UJ	ND UJ	ND UJ	ND UJ
GM-16S	3/30/2023	ND UJ	360 J	ND UJ	0.68 J
GM-17S	3/30/2023	ND UJ	ND UJ	ND UJ	ND UJ
GM-24S	3/30/2023	250 J	310 J	ND UJ	ND UJ
AR-03	3/29/2023	ND UJ	790 J	ND UJ	ND UJ
AMW-01	3/29/2023	ND UJ	ND UJ	ND UJ	ND UJ
AMW-02	3/29/2023	ND UJ	ND UJ	ND UJ	**200 J**
AMW-03	3/29/2023	ND UJ	ND UJ	ND UJ	ND UJ
AMW-04	3/30/2023	ND UJ	ND UJ	ND UJ	ND UJ
AMW-05	3/30/2023	ND UJ	ND UJ	ND UJ	ND UJ
MW-1-T9	3/31/2023	240	1,200	ND	ND
MW-2-T9	3/31/2023	230	530	ND	ND
MW-3-T9	3/29/2023	670 J	1300 J	ND UJ	17 J
Cleanup Level		1,000	10,000	10,000	71
Method Reporting Limit		50	250	750	0.5

Notes:

Values in **bold** exceed the cleanup level.

Definitions:

EPA 8260	EPA method of analysis for volatile organic compounds in water.
µg/L	Micrograms per liter.
ND	Constituent not detected above listed method reporting limit.
TPH	Total petroleum hydrocarbons.
TPH-D	Total petroleum hydrocarbons as diesel.
TPH-G	Total petroleum hydrocarbons as gasoline.
TPH-O	Total petroleum hydrocarbons as oil.
NWTPH-Dx	Northwest TPH method for analysis of diesel in water - extended.
NWTPH-Gx	Northwest TPH method for analysis of gasoline in water - extended.
J	Estimated value.
UJ	Not detected at an estimated value.

Table 6. Summary of Free Product Measurement Results for Groundwater
2023 Monitoring Data
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Well	Date	Free Product (feet)
Plant 1		
GM-11S	1/26/2023	None
GM-11S	2/23/2023	None
GM-11S	3/23/2023	None
GM-11S	4/20/2023	None
GM-11S	5/25/2023	None
GM-11S	6/22/2023	None
GM-12S	1/26/2023	None
GM-12S	2/23/2023	None
GM-12S	3/23/2023	None
GM-12S	4/20/2023	None
GM-12S	5/25/2023	None
GM-12S	6/22/2023	None
GM-13S	1/26/2023	None
GM-13S	2/23/2023	None
GM-13S	3/23/2023	None
GM-13S	4/20/2023	None
GM-13S	5/25/2023	None
GM-13S	6/22/2023	None
Cleanup Level		No Sheen

Notes: Values in **bold** exceed the cleanup level.

Table 7. Summary of Data Validation Results
Groundwater Performance Monitoring
First Quarter 2023
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Sample ID	Constituent	Qualifier	Reason
P1-GWAMW-02-123 P1-GWAMW-202-123	Benzene	J	The RPD for benzene in the field duplicate pair P1-GWAMW-02-123 / P1-GWAMW-202-123 is greater than the 20% control limit. Results for these samples are, therefore, qualified as estimated values (J).
P1-GWAMW-02-123 P1-GWAMW-202-123 P1-GWMW-3-T9-123 P1-GWGM-14S-123 P1-GWGM-16S-123	Benzene	J	Samples were received by the laboratory on 3/31/23 at a temperature greater than 6°C. Samples collected on 3/29/23 and 3/30/23 may not have been maintained within the recommended temperature range. Positive results for those samples are, therefore, qualified as estimated values (J).
P1-GWAMW-01-123 P1-GWAMW-03-123 P1-GWGM-15S-123 P1-GWAR-03-123 P1-GWAMW-04-123 P1-GWAMW-05-123 P1-GWGM-24S-123 P1-GWGM-224S-123 P1-GWGM-17S-123	Benzene	UJ	Samples were received by the laboratory on 3/31/23 at a temperature greater than 6°C. Samples collected on 3/29/23 and 3/30/23 may not have been maintained within the recommended temperature range. Negative results for those samples are, therefore, qualified as undetected at an estimated reporting limit (UJ).
P1-GWMW-3-T9-123 P1-GWGM-24S-123 P1-GWGM-224S-123 P1-GWGM-14S-123	Gasoline	J	Samples were received by the laboratory on 3/31/23 at a temperature greater than 6°C. Samples collected on 3/29/23 and 3/30/23 may not have been maintained within the recommended temperature range. Positive results for those samples are, therefore, qualified as estimated values (J).
P1-GWAMW-02-123 P1-GWAMW-202-123 P1-GWAMW-01-123 P1-GWAMW-03-123 P1-GWGM-15S-123 P1-GWAR-03-123 P1-GWAMW-04-123 P1-GWAMW-05-123 P1-GWGM-16S-123 P1-GWGM-17S-123	Gasoline	UJ	Samples were received by the laboratory on 3/31/23 at a temperature greater than 6°C. Samples collected on 3/29/23 and 3/30/23 may not have been maintained within the recommended temperature range. Negative results for those samples are, therefore, qualified as undetected at an estimated reporting limit (UJ).
P1-GWAR-03-123 P1-GWMW-3-T9-123 P1-GWGM-24S-123 P1-GWGM-224S-123 P1-GWGM-14S-123 P1-GWGM-16S-123	Diesel	J	Samples were received by the laboratory on 3/31/23 at a temperature greater than 6°C. Samples collected on 3/29/23 and 3/30/23 may not have been maintained within the recommended temperature range. Positive results for those samples are, therefore, qualified as estimated values (J).
P1-GWAMW-02-123 P1-GWAMW-202-123 P1-GWAMW-01-123 P1-GWAMW-03-123 P1-GWGM-15S-123 P1-GWAMW-04-123 P1-GWAMW-05-123 P1-GWGM-17S-123	Diesel	UJ	Samples were received by the laboratory on 3/31/23 at a temperature greater than 6°C. Samples collected on 3/29/23 and 3/30/23 may not have been maintained within the recommended temperature range. Negative results for those samples are, therefore, qualified as undetected at an estimated reporting limit (UJ).

Table 7. Summary of Data Validation Results
Groundwater Performance Monitoring
First Quarter 2023
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Sample ID	Constituent	Qualifier	Reason
P1-GWAR-03-123 P1-GWMW-3-T9-123	Diesel	J	Some samples were extracted past the holding time. Positive results for these samples are qualified as estimated values (J).
P1-GWAMW-02-123 P1-GWAMW-202-123 P1-GWAMW-01-123 P1-GWAMW-03-123 P1-GWGM-15S-123	Diesel	UJ	Some samples were extracted past the holding time. Negative results for these samples are qualified as undetected at an estimated reporting limit (UJ).
P1-GWAMW-02-123 P1-GWAMW-202-123 P1-GWAMW-01-123 P1-GWAMW-03-123 P1-GWGM-15S-123 P1-GWAR-03-123 P1-GWMW-3-T9-123 P1-GWAMW-04-123 P1-GWAMW-05-123 P1-GWGM-24S-123 P1-GWGM-224S-123 P1-GWGM-14S-123 P1-GWGM-16S-123 P1-GWGM-17S-123	Oil	UJ	Samples were received by the laboratory on 3/31/23 at a temperature greater than 6°C. Samples collected on 3/29/23 and 3/30/23 may not have been maintained within the recommended temperature range. Negative results for those samples are, therefore, qualified as undetected at an estimated reporting limit (UJ).
P1-GWAMW-02-123 P1-GWAMW-202-123 P1-GWAMW-01-123 P1-GWAMW-03-123 PT-GWGM-15S-123 P1-GWAR-03-123 P1-GWMW-3-T9-123	Oil	UJ	Some samples were extracted past the holding time. Negative results for these samples are qualified as undetected at an estimated reporting limit (UJ).

Definitions:
J The associated result is qualified as an estimated value.
RPD Relative Percent Difference
UJ The associated result is qualified as undetected at an approximate quantitation limit.

Table 8. Summary of Analytical Results for Soil & Groundwater
Northwest Waterfront Impacted Area (NWWF)
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Well/Loc ID	Type	Units	Depth (ft BGS)	Date	TPH-G NWTPH-Gx	TPH-D NWTPH-Dx	TPH-O NWTPH-Dx	Benzene EPA 8021
GM-10S	Groundwater	µg/L	NA	2/28/2023	ND	ND	ND	ND
HMW-01S	Groundwater	µg/L	NA	2/28/2023	ND	ND	ND	ND
B-007	Groundwater	µg/L	NA	2/28/2023	ND	ND	ND	ND
21T-SS-022123	Soil/Gravel	mg/kg	0.5-1.0	2/21/2023	2,100	4,800	ND	NA
21T-SS-022823	Soil	mg/kg	4.5-5.5	2/28/2023	8.5	330	ND	ND
DA1-VLT-01	Soil	mg/kg	4.5-5.5	6/12/2023	5,000	**12,000**	ND	ND*
DA1-TR01-35	Soil	mg/kg	3.5-4.5	6/20/2023	ND	120	95	ND*
DA1-TR02-35	Soil	mg/kg	3.5-4.5	6/20/2023	ND	56	72	ND*
Cleanup Level (Groundwater, µg/L)					1,000	10,000	10,000	71
Cleanup Level (Soil, Gas+Diesel+Oil, mg/kg)					10,000	10,000	10,000	NA
Method Reporting Limit (Groundwater, µg/L)					50	250	750	0.5
Method Reporting Limit (Soil, mg/kg)					3	25	50	0.005

Notes:
Values in **bold** exceed the cleanup level.

Definitions:

EPA 8021	EPA method of analysis for volatile organic compounds.
*EPA 8260	EPA method of analysis for volatile organic compounds
µg/L	Micrograms per liter
mg/kg	Miligrams per kilogram
ND	Constituent not detected above listed method reporting limit.
TPH	Total petroleum hydrocarbons.
TPH-D	Total petroleum hydrocarbons as diesel.
TPH-G	Total petroleum hydrocarbons as gasoline.
TPH-O	Total petroleum hydrocarbons as oil.
NWTPH-Dx	Northwest TPH method for analysis of diesel in water - extended.
NWTPH-Gx	Northwest TPH method for analysis of gasoline in water - extended.
NA	Not applicable
BGS	Below Ground Surface
ft	Feet

Table 9. Duwamish Waterway and Containment Boom Surface Water Sheen Monitoring
Site: Seaport Seattle Terminal (Former ARCO/BP Harbor Island Terminal)

Date	Tidal Stage		Loading Rack Area Boom Sheen Observations		Warehouse Area North Boom Sheen Observations		Warehouse Area South Boom Sheen Observations	
	Low, Medium (ebb & flood), High	Tide Rating (See Notes)	Sheen (**Yes**/No)	Sheen Rating (See Notes)	Sheen (**Yes**/No)	Sheen Rating (See Notes)	Sheen (**Yes**/No)	Sheen Rating (See Notes)
1/3/2023	medium	1	No	0.0	No	0.0	No	0.0
1/10/2023	high	2	No	0.0	No	0.0	No	0.0
1/12/2023	high	2	No	0.0	No	0.0	No	0.0
1/24/2023	high	2	No	0.0	No	0.0	No	0.0
1/31/2023	medium	1	No	0.0	No	0.0	No	0.0
2/7/2023	high	2	No	0.0	No	0.0	No	0.0
2/16/2023	medium	1	No	0.0	No	0.0	No	0.0
2/21/2023	high	2	No	0.0	No	0.0	No	0.0
2/22/2023	low	0	No	0.0	No	0.0	No	0.0
2/23/2023	high	2	No	0.0	No	0.0	No	0.0
2/28/2023	medium	1	No	0.0	No	0.0	No	0.0
3/1/2023	high	2	No	0.0	No	0.0	No	0.0
3/7/2023	low	0	No	0.0	No	0.0	No	0.0
3/14/2023	medium	1	No	0.0	No	0.0	No	0.0
3/21/2023	high	2	No	0.0	No	0.0	No	0.0
3/28/2023	high	2	No	0.0	No	0.0	No	0.0
4/7/2023	high	2	No	0.0	No	0.0	No	0.0
4/12/2023	high	2	No	0.0	No	0.0	No	0.0
4/18/2023	low	0	No	0.0	No	0.0	No	0.0
4/25/2023	medium	1	No	0.0	No	0.0	No	0.0
5/2/2023	low	0	No	0.0	No	0.0	No	0.0
5/7/2023	low	0	No	0.0	No	0.0	No	0.0
5/16/2023	low	0	No	0.0	No	0.0	No	0.0
5/23/2023	high	2	No	0.0	No	0.0	No	0.0
5/30/2023	medium	1	No	0.0	No	0.0	No	0.0
6/6/2023	low	0	No	0.0	No	0.0	No	0.0
6/13/2023	medium	1	No	0.0	No	0.0	No	0.0
6/20/2023	medium	1	No	0.0	No	0.0	No	0.0
6/22/2023	low	0	No	0.0	No	0.0	No	0.0

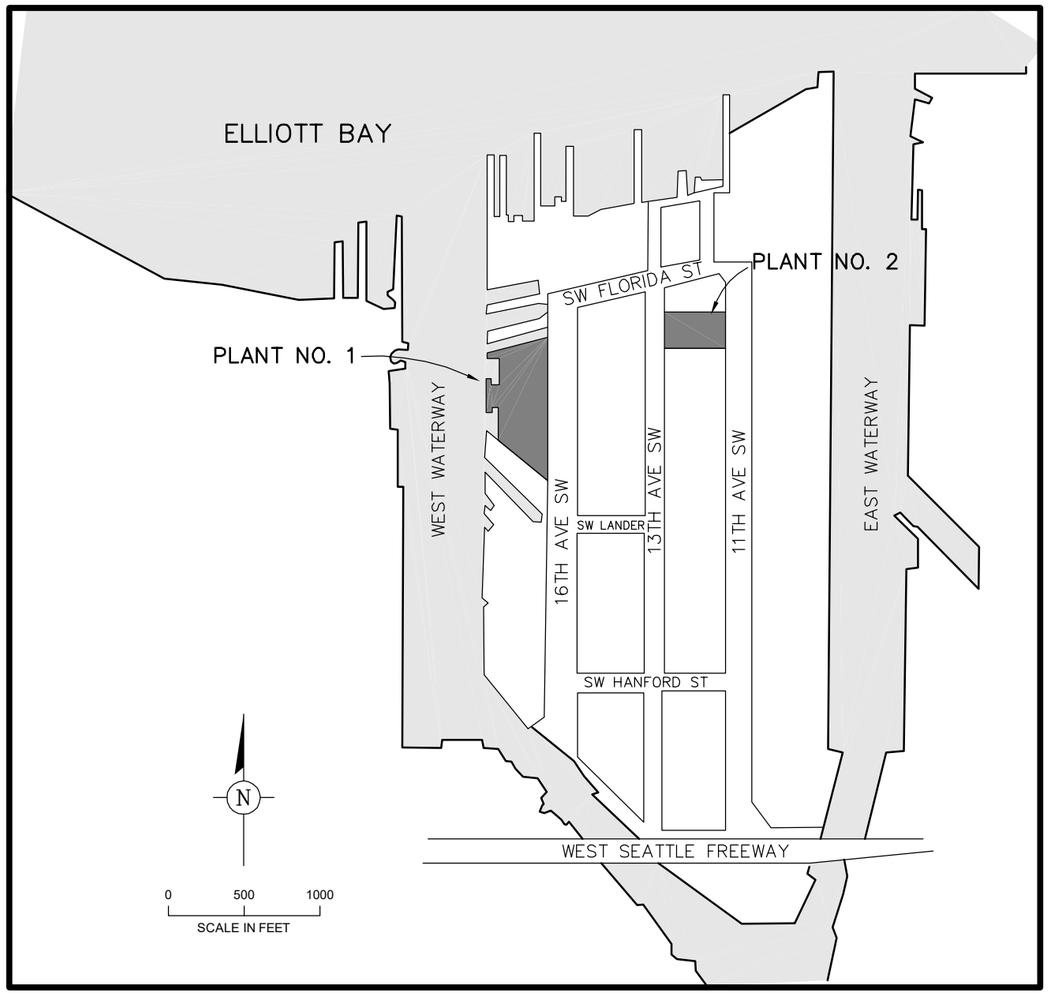
Notes:
Bold entries represent sheen detections.
Loading Rack Area Boom removed in August 2017 with concurrance from Ecology due to persistent lack of sheens.
South Boom removed in April 2022 with concurrance from Ecology due to persistent lack of sheens.

* Sheen Appearance is rated from 0.0 to 3.0 using criteria below;
0.0 No sheen present
0.5 Very light , sheen that rapidly dissapates
1.0 Light sheen visible in one location
2.0 Sheen visible in several locations and is brightly colored
3.0 Sheen covers large areas of boom, outside boom, and/or LNAPL floating on surface

Notes Continued:
** Tide Level is rated from 0.0 to 2.0 using the criteria below;
0.0 Low Tide
1.0 Medium Tide (Ebb Tide & Flood Tide)
2.0 High Tide

FIGURES

AREA PLAN



SITE PLAN

TECHSOLVE ENVIRONMENTAL
7518 NE 169th Street, Kenmore WA 98028
(425) 402-8277 FAX (425) 402-7917

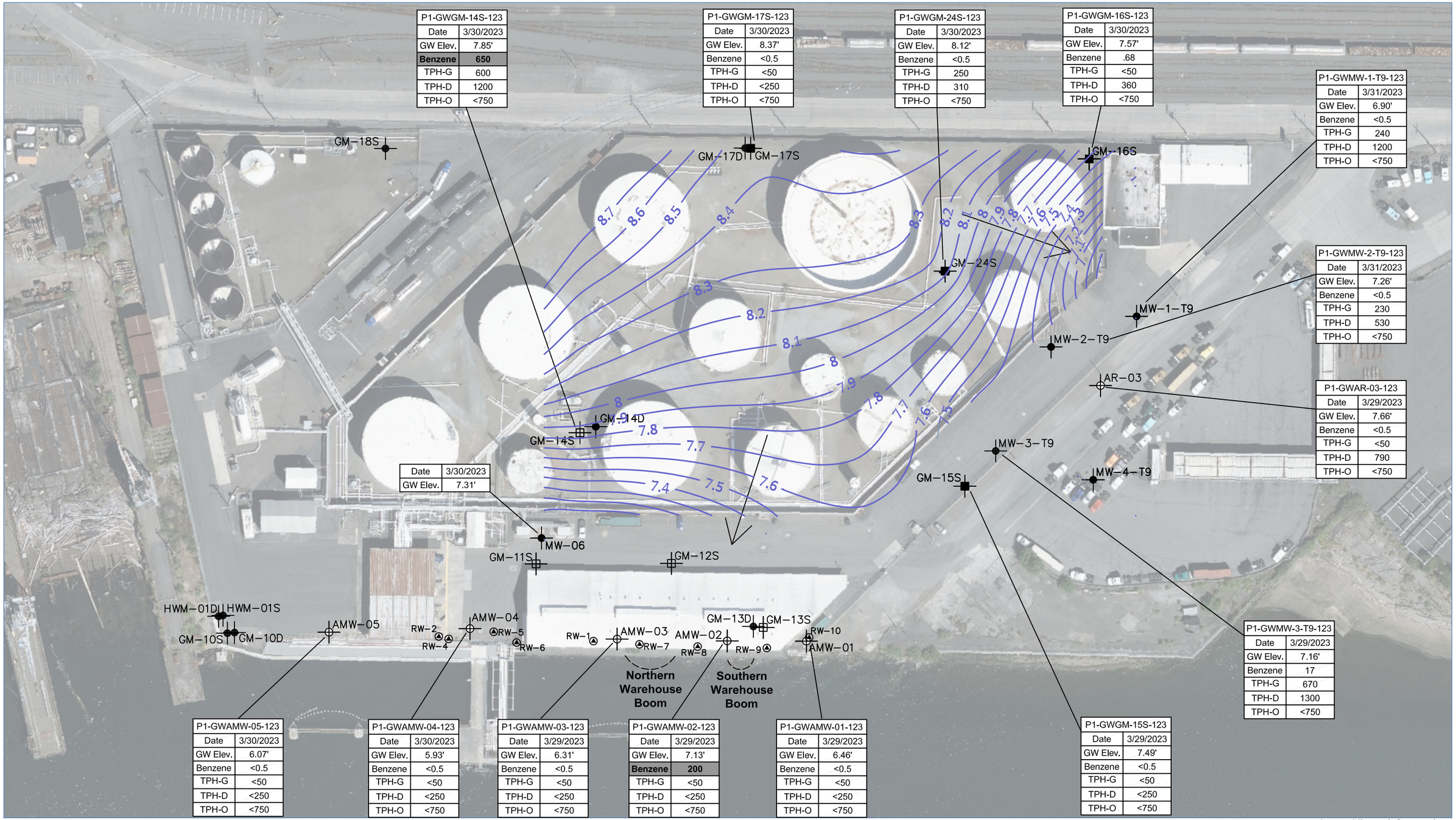
Site Location Map

Site: SeaPort Seattle Terminal
(Former ARCO / BP Harbor Island Terminal)

1652 Southwest Lander Street
Seattle, WA 98134

FIGURE

1



P1-GWGM-14S-123	
Date	3/30/2023
GW Elev.	7.85'
Benzene	**650**
TPH-G	600
TPH-D	1200
TPH-O	<750

P1-GWGM-17S-123	
Date	3/30/2023
GW Elev.	8.37'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWGM-24S-123	
Date	3/30/2023
GW Elev.	8.12'
Benzene	<0.5
TPH-G	250
TPH-D	310
TPH-O	<750

P1-GWGM-16S-123	
Date	3/30/2023
GW Elev.	7.57'
Benzene	.68
TPH-G	<50
TPH-D	360
TPH-O	<750

P1-GWMW-1-T9-123	
Date	3/31/2023
GW Elev.	6.90'
Benzene	<0.5
TPH-G	240
TPH-D	1200
TPH-O	<750

P1-GWMW-2-T9-123	
Date	3/31/2023
GW Elev.	7.26'
Benzene	<0.5
TPH-G	230
TPH-D	530
TPH-O	<750

P1-GWAR-03-123	
Date	3/29/2023
GW Elev.	7.66'
Benzene	<0.5
TPH-G	<50
TPH-D	790
TPH-O	<750

Date	3/30/2023
GW Elev.	7.31'

P1-GWMW-3-T9-123	
Date	3/29/2023
GW Elev.	7.16'
Benzene	17
TPH-G	670
TPH-D	1300
TPH-O	<750

P1-GWAMW-05-123	
Date	3/30/2023
GW Elev.	6.07'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWAMW-04-123	
Date	3/30/2023
GW Elev.	5.93'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWAMW-03-123	
Date	3/29/2023
GW Elev.	6.31'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWAMW-02-123	
Date	3/29/2023
GW Elev.	7.13'
Benzene	**200**
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWAMW-01-123	
Date	3/29/2023
GW Elev.	6.46'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

P1-GWGM-15S-123	
Date	3/29/2023
GW Elev.	7.49'
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

LEGEND

- GM–16S Monitoring Well
- RW–5 Recovery Well
- AMW–01 Performance/Confirmation Well
- GM–13D Performance Well
- GM–13S Product Performance Well
- Groundwater Flow Direction
- Groundwater Contour (Feet NAVD88)

Sample ID		CUL
Date	Date Sample Collected	–
GW Elev.	Groundwater Elevation in Feet NAVD88	–
Benzene	Benzene (EPA 8260) in µg/L	71
TPH-G	Total Petroleum Hydrocarbons as Gasoline (NWTPH-GX) in µg/L	1,000
TPH-D	Total Petroleum Hydrocarbons as Diesel (NWTPH-DX) in µg/L	10,000
TPH-O	Total Petroleum Hydrocarbons as Oil (NWTPH-DX) in µg/L	10,000

Notes: **Bold** - Detected concentration exceeds site specific cleanup level
< = Not detected at listed laboratory reporting limit

N

0 50 100
SCALE IN FEET

TECHSOLVE ENVIRONMENTAL
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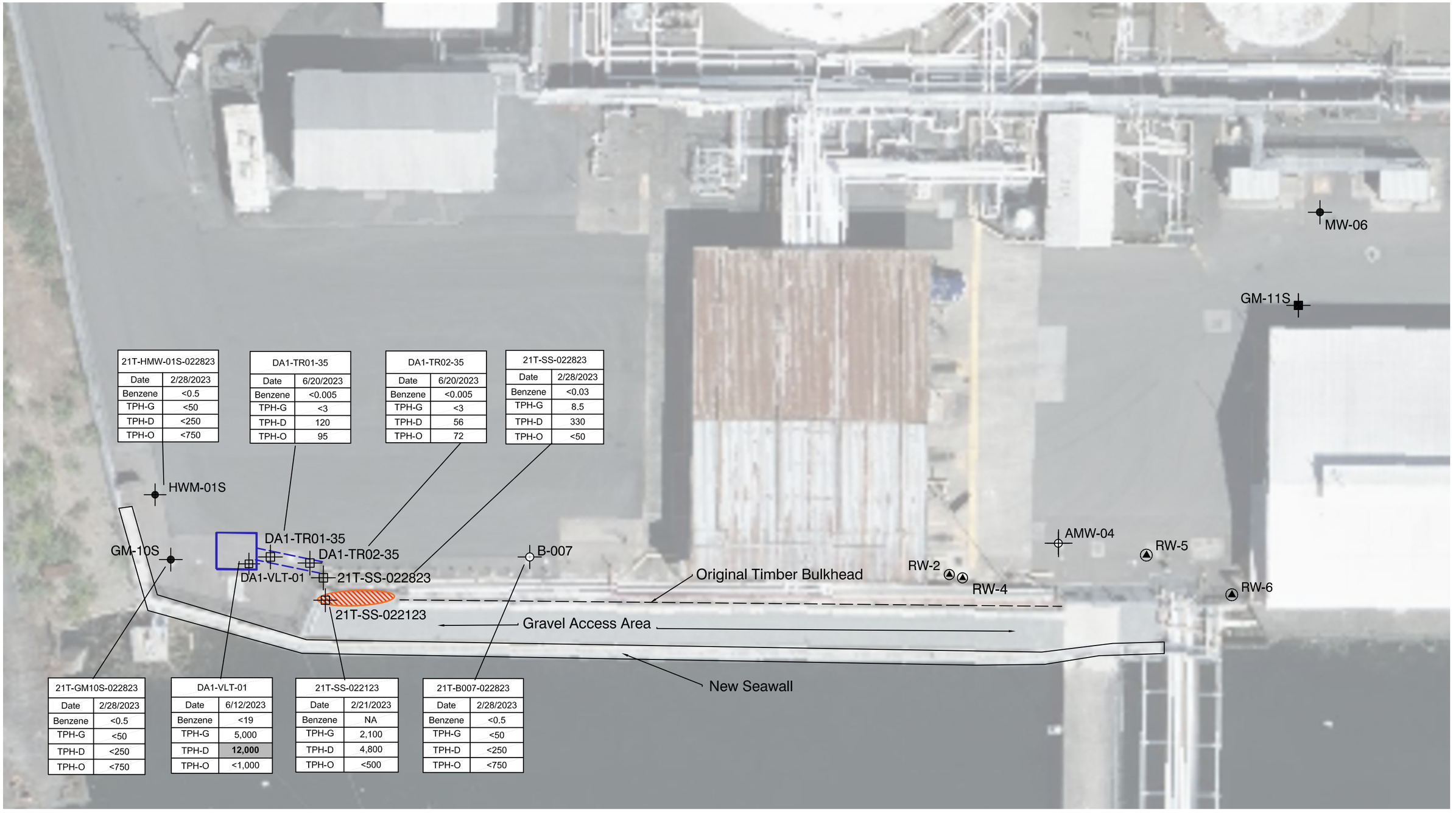
Plant 1 First Quarter 2023
GW Monitoring Analytical Results & Contours

SeaPort Seattle Terminal (Former ARCO/BP Harbor Island Terminal)
1652 Southwest Lander Street
Seattle, WA 98134

FIGURE
2



21T-HMW-01S-022823	
Date	2/28/2023
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

DA1-TR01-35	
Date	6/20/2023
Benzene	<0.005
TPH-G	<3
TPH-D	120
TPH-O	95

DA1-TR02-35	
Date	6/20/2023
Benzene	<0.005
TPH-G	<3
TPH-D	56
TPH-O	72

21T-SS-022823	
Date	2/28/2023
Benzene	<0.03
TPH-G	8.5
TPH-D	330
TPH-O	<50

21T-GM10S-022823	
Date	2/28/2023
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

DA1-VLT-01	
Date	6/12/2023
Benzene	<19
TPH-G	5,000
TPH-D	**12,000**
TPH-O	<1,000

21T-SS-022123	
Date	2/21/2023
Benzene	NA
TPH-G	2,100
TPH-D	4,800
TPH-O	<500

21T-B007-022823	
Date	2/28/2023
Benzene	<0.5
TPH-G	<50
TPH-D	<250
TPH-O	<750

LEGEND

- GM-10S MONITORING WELL
- B-007 PEIZOMETER
- 21T-22 SOIL SAMPLE
- AREA of STAINING

STORMWATER IMPROVEMENTS

- VAULT
- TRENCH

Sample ID	
Date	Date Sample Collected
Benzene	Benzene (EPA 8260)
TPH-G	Total Petroleum Hydrocarbons as Gasoline (NWTPH-GX)
TPH-D	Total Petroleum Hydrocarbons as Diesel (NWTPH-DX)
TPH-O	Total Petroleum Hydrocarbons as Oil (NWTPH-DX)

Notes: **Bold** - Detected concentration exceeds site specific cleanup level
< = Not detected at listed laboratory detection limit
Concentrations are reported in µg/L for water and mg/kg for soil

N

0 25

SCALE IN FEET

TECHSOLVE ENVIRONMENTAL
7518 N.E. 169th Street
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NW Waterfront Impacted Area Analytical Results 2023

SeaPort Seattle Terminal (Former ARCO/BP Harbor Island Terminal)
1652 Southwest Lander Street
Seattle, WA 98134

FIGURE 3

C:\Users\Lynn\OneDrive - Techsolve\Documents\Aproject\ARCO 21T\Drawings and CAD files\Autocad Files\Lynn CAD File